

WHAT IS CLAIMED IS:

1. Method for forming an article comprising closed-cell microfoam from thermoplastic, wherein at least one molten thermoplastic comprising a foaming agent is subjected under pressure to a forming operation and, after the pressure has been released, is cooled, wherein the amount of foaming agent is substantially identical to the amount corresponding to that quantity of gas incorporated in the foaming agent which is comprised by a close-packed structure of the foam cells having a foam-cell diameter, which is substantially uniform throughout the foam.

2. Method according to claim 1, wherein the foaming agent is selected from the group consisting of physical foaming agents and chemical foaming agents.

3. Method according to claim 2, wherein the foaming agent is a physical foaming agent selected from the group consisting of carbon dioxide, nitrogen, air, oxygen, noble gases, water and isoalkanes such as isopentane.

4. Method according to claim 2, wherein the foaming agent is a chemical foaming agent such as sodium bicarbonate and azodicarbonamid and mixtures with other additives comprising these.

5. Method according to claim 3, wherein the foaming agent is nitrogen and is used in the processing of polypropylene in an amount of about 0.12% based on the weight of the thermoplastic.

6. Method according to claim 3, wherein the foaming agent is carbon dioxide and is used in the processing of polypropylene in an amount of about 0.19% based on the weight of the thermoplastic.

7. Method according to claim 1 wherein the pressure drop rate dP/dt is controlled according to the following equation:

$$\frac{dP}{dt} > \frac{\beta \cdot R_o \cdot C_{ba}^2}{\eta H^2}$$

wherein:

β is a proportionality factor,

R_o is the critical cell radius in m,

C_{ba} is the concentration of blowing agent in g/cm³,

η is the viscosity of the melt in Pa.s,

H is Henri's constant,

$\frac{dP}{dt}$ is expressed in $\frac{\text{Pa}}{\text{sec.}}$

8. Method according to claim 7 wherein for preparing a polypropylene foam dP/dt at 180° - 190°C is set at ≥ 20 MPa/sec. and at 170 - 175°C at ≥ 10 MPa/sec, in any case however $dP/dt \leq 50$ MPa/sec.

9. Method according to claim 1, wherein the method is an extrusion method wherein at least one stream of thermoplastic is forced under pressure through an orifice, which gives the object to be formed its shape, and is then cooled, and wherein at least one stream comprises a foaming agent.

10. Method according to claim 1, wherein a nucleation agent is present in the thermoplastic.

11. Method according to claim 10, wherein a nucleating agent having an aspect ratio of between 5 and 100 is used.

12. Method according to claim 10, wherein the nucleating agent used is talc having a mean particle size of > 3 micrometres and preferably > 10 micrometres.

13. Method according to claim 10, wherein the concentration of nucleating agent is chosen in conjunction with the desired mean foam-cell diameter.

14. Method according to claim 12, wherein the nucleating agent used is talc in amounts suitable for the foam-cell diameter of polypropylene to be formed as follows:

Wt% of filler	Mean foam-cell diameter in micrometres
2.5	300-500
5	150-250
10	80-120
20	40-60
40	20-30

15. Method according to claim 12 for forming a polyvinylchloride foam wherein 3 up to 5 or more weight % of talc is used to obtain a foam having a mean foam cell diameter

EQUATION 1

sub a²

of about 50 μm .

16. Method according to claim 1, wherein the thermoplastic is admixed with an agent which improves the impact resistance of the plastic (an impact modifier).

Sub a³
17. Method according to claim 16, wherein the plastic is polypropylene and the impact modifier is selected from the group of polymeric modifiers such as low-crystallinity PP, LDPE, ABS, MBS, EVA, chlorinated PE and the like or mixtures thereof, and the agent or mixture of agents is used in a concentration of 2-40%, based on the weight of the thermoplastic, and preferably of 5-15%.

18. Method according to one or more of the preceding claims, wherein the thermoplastic is admixed with a surface-active agent.

19. Method according to claim 18, wherein the surface-active agent is selected from the group consisting of fatty alcohols, esters based on dicarboxylic acids and natural short-chain fats/alcohols, esters of alcohols and long-chain fatty acids and the like or mixtures thereof, and the agent is used in a concentration of 0.1 - 5% based on the weight of the thermoplastic.

20. Method according to claim 19, wherein the surface-active agent is used in a concentration of 0.3-3 wt%, preferably in a concentration of 0.5-2%.

21. Method according to claim 9, wherein the formed article is a pipe whose inner and/or outer walls have a foam-cell diameter of less than 10 micrometres.

22. Method according to claim 9, wherein the formed article is a pipe and, to form a completely tight inner and outer wall of the pipe, the method is implemented as a coextrusion method and the stream of thermoplastic for the inner and outer wall is supplied free from gas, whereas gas and nucleation agent are fed into the stream for the part between the inner and outer walls to adjust the foam-cell diameter therein to a predetermined value by choosing the concentration of nucleation agent.

23. Method for forming an article comprising closed-cell microfoam from thermoplastic, wherein at least one molten thermoplastic comprising a foaming agent is subjected under pressure to a forming operation and, after the pressure has been released, is cooled, wherein the amount of foaming agent is at

most identical to the amount corresponding to that quantity of gas incorporated in the foaming agent which is comprised by a close-packed structure of the foam cells having a foam-cell diameter, which is substantially uniform throughout the foam.

24. Method according to claim 23, wherein the foaming agent is selected from the group consisting of physical foaming agents and chemical foaming agents.

25. Method according to claim 24, wherein the foaming agent is a physical foaming agent selected from the group consisting of carbon dioxide, nitrogen, air, oxygen, noble gases, water and isoalkanes such as isopentane.

26. Method according to claim 25, wherein the foaming agent is a chemical foaming agent such as sodium bicarbonate and azodicarbonamid and mixtures with other additives comprising these.

27. Method according to claim 25, wherein the foaming agent is nitrogen and is used in the processing of polypropylene in an amount of about 0.12% based on the weight of the thermoplastic.

28. Method according to claim 27, wherein an amount of 0,05 0,10 wt.% based on the weight of the thermoplastic is used.

29. Method according to claim 25, wherein the foaming agent is carbon dioxide and is used in the processing of polypropylene in an amount of about 0.19% based on the weight of the thermoplastic.

30. Method according to claim 29, wherein an amount of 0,10-0,15 wt.% based on the weight of thermoplastic is used.

31. Method according to any of the claims 23-30, wherein said method includes the aspects as given in any of the claims 7-22.

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